

which, after having lost the tip, or even the distal half of one or more of the sessile arms, have more or less completely reproduced the lost parts. In such cases the restored portion is often more slender and has smaller suckers than the normal arms; and where the old part joins the new there is often an abrupt change in size. Probably this difference would wholly disappear after a longer time.

An unquestionable and most remarkable example of the reproduction of several entire arms occurs in a small specimen taken off Newport, R. I., Aug. 1880. This has the mantle 70 millim. long, dorsal arms 22 millim., third pair of arms 30 millim. The three upper pairs of arms are perfectly normal; but both the tentacular and both the ventral arms have evidently been entirely lost and then reproduced from the very base. These four arms are now nearly perfect in form, but are scarcely half their normal size on the left side, and still smaller on the right side. The left tentacular arm is only 24 millim. long, and very slender, but it has the normal proportion of club, and the suckers, though well formed, are diminutive, and those of the two median rows are scarcely larger than the lateral ones and delicately denticulated. The right tentacular arm is less than half as long (12 millim.), being of about the same length as the restored ventral one of the same side; it is also very slender, and its suckers very minute and soft, in four equal rows. The right ventral arm is only 14 millim. long, the left one 15 millim. long; both are provided with very small but otherwise normal suckers.

In another specimen from Vineyard Sound, a female, with the mantle about 150 millim. long, one of the tentacular arms had lost its club; but the wound had healed, and a new club was in process of formation. This new club is represented by a small tapering acute process, starting out obliquely from the stump and having a sigmoid curvature; its inner surface is covered with very minute suckers. The other arms are normal.

It seems probable that some of the normal European species of *Loligo* that have been based on the smaller size of the tentacular arms or of the suckers are due to similar instances of regeneration of these parts.—*Amer. Journ. Sci.*, April 1881.

*Note on Wardichthys cyclosoma, Traq.* By THOMAS STOCK, Natural-History Department, Museum of Science and Art, Edinburgh\*.

A small fish was described and figured by Dr. R. H. Traquair in the 'Annals' for April 1875, vol. xv. p. 262, pl. xvi. figs. 1-5, in a paper entitled "On some Fossil Fishes from the Neighbourhood of Edinburgh." The description was drawn up from a single specimen obtained by him from the Wardie Shales about fifteen years previously. A new genus was established for its reception under the name of *Wardichthys*, so called in honour of Mr. John Ward, F.G.S., of Longton, Staffordshire, a well-

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known collector of fossil fishes, and an author of repute in departments of geology and palæontology, and not with reference to the locality where it was found. The specific name *cyclosoma* was given in allusion to its nearly circular shape. The original specimen, though not entire, was very nearly so, being, however, deficient in the dentition and the tail. This interesting fish has remained unique until the present time. I am able, however, as a part of the good fortune which has attended my work upon the Wardie Shales, to announce the occurrence of a second specimen. It lay high upon the shore, apparently cast there by a lad. Like the original specimen, it occurs in a nodule, of which, however, only a fragment (and the less important fragment) has been recovered. A careful search was instituted for the remainder, but without success; and it is to be feared that the counterpart is irrecoverably lost. That an interval of about twenty years should have elapsed between the occurrence of the first and second examples shows that it is a fish of great rarity. Its rediscovery, however, holds out the hope that other specimens will be found if the bed (for it appears each time to have occurred in a particular bed of the Wardie series) be at intervals carefully searched.

The specimen here noted unfortunately throws very little additional light upon the structure of the fish. The dentition and the tail remain, as before, unknown. A portion of the flank with about ten series of scales is nearly all that has been preserved. The shape of the scales and their superficial ornament are very well shown in impression, the latter consisting of the characteristic tuberculation, which makes this an easily identifiable fish. The weathering action of the sea has been favourable to the disclosure of these characters. The configuration and sculpture of the scales are not often so well seen in fishes preserved in nodules. The chances are, when the nodule is violently fractured by the hammer and chisel, that the halves separate in such a way that only the undersides of the scales are visible. Sometimes the plane of fracture lies right through the scales; and it is difficult in such cases to get at their shape or sculpture by the employment of artificial aids. By the more gradual process of weathering the nodule almost invariably splits along the plane most favourable to the display of the superficial characters. The writer has succeeded in obtaining for his collection several fragments or entire specimens which have been preserved in this way. Where the weathering has proceeded far enough, as it has done in several cases, the ornament has been exquisitely brought out; and in several large fragments or entire specimens of *Rhadinichthys* and *Cosmoptychius* there is very little left in this respect to desire. From these natural moulds plaster-casts may be easily obtained. Other specimens only await the application of acid to bring out their characters in an equally distinct fashion.

The possession of a plaster cast of the type specimen, due to the kindness of Dr. Traquair, places the accuracy of the generic identification beyond a doubt; and though the cast does not show the

ornament quite so well as might be desired, the agreement in this character between my specimen and the original figures and description is such as to make the specific determination also a matter of certainty.

*On the Anatomy of Pyrosoma.* By M. L. JOLIET.

*Growth of the Colony.*—All the observers who have paid attention to *Pyrosoma* have remarked that the closed extremity of the colony is occupied by four ascidiozooids. According to Savigny and Lesueur these are the four primitive individuals developed in the egg itself. As regards *Pyrosoma elegans*, in which, as stated by Keferstein and Ehlers, the endostyle is on the side of the common orifice, I cannot say how this may be; but in *Pyrosoma giganteum* things are different. Panceri has already remarked that the terminal ascidiozooids are destitute of those muscular cords which terminate at the periphery of the common cloacal aperture, and which are possessed by the primitive ascidiozooids. Moreover, in *P. giganteum*, as in *P. atlanticum*, the endostyle, and consequently the germinative point, are turned in the direction of the closed extremity. It follows that an animal placed at a given moment in the immediate vicinity of that extremity is necessarily separated therefrom some time afterwards by the three or four buds which it has directly produced, and, still later, not only by these but by their derivatives.

When we examine the closed extremities of several quite adult colonies, measuring several centimetres in length, we see that the four individuals forming the terminal whorl are in one specimen perfectly adult and beginning to breed, in another young and still furnished with an elæoblast, elsewhere, again, in the condition of simple buds, forming part of the stolon, and not yet detached from the parent. In a word, the terminal whorl of one colony does not resemble that of another colony of the same age, which would not be the case if this whorl were the primitive whorl. From these facts we see that if we desire to find the four primitive individuals, it is not at the closed extremity that we must seek for them, but at the open extremity. They are, in fact, incessantly pushed away from the former by the whole of their progeny.

*Nervous System.*—On the posterior median line there exists a nerve which traverses it throughout nearly its whole extent. It does not originate directly from the ganglion, but from a train of cells which seem to prolong the latter backwards, runs above the base of the languets, and appears to act upon a bundle of muscular fibres, which, passing behind the œsophagus, traverses the cloaca skirting the subintestinal peritoneal lamina.

In the four primitive ascidiozooids the two thick lateral posterior nerves terminate at the two muscular cords which start from the two sides of the œsophagus and run to the common cloaca. In the ordinary individuals there only exists one of these muscular cords; it is median, and morphologically represents the two cords of the primitive individuals; for it receives both the nerves.